Decision Rationale

Total Maximum Daily Load of
Nitrogen and Phosphorus for
Corsica River
Queen Anne's County, Maryland
4/16/2000

I. Introduction

This document will set forth the Environmental Protection Agency's (EPA) rationale for approving the Total Maximum Daily Loads (TMDLs) of Nitrogen and Phosphorus to the Corsica River submitted for final Agency review on April 7, 2000. Our rationale is based on the TMDL, Technical Memorandum, and other information provided in the submittal document to determine if the TMDL meets the following 8 regulatory conditions pursuant to 40 CFR §130.

1) The TMDLs are designed to implement applicable water quality standards.
2) The TMDLs include a total allowable load as well as individual waste load allocations and load allocations.
3) The TMDLs consider the impacts of background pollutant contributions.
4) The TMDLs consider critical environmental conditions.
5) The TMDLs consider seasonal environmental variations.
6) The TMDLs include a margin of safety.
7) The TMDLs have been subject to public participation.
8) There is reasonable assurance that the TMDLs can be met.

The Technical Memoranda, *Significant Nutrient Point Sources in the Corsica River Watershed* and *Significant Nonpoint Sources in the Corsica River Watershed* submitted by the Maryland Department of the Environment (MDE), specifically allocates nitrogen and phosphorus to one point source as well as to each of 4 separate land use/source categories (direct atmospheric deposition of nitrogen or phosphorus to the water surface is obviously not considered a "land use" source). Each land use or source is allocated some percentage of the total allowed nutrient load originating from nonpoint sources. Current nonpoint source load estimates were based on the Chesapeake Bay Model Phase IV Year 2000 loading coefficients which considers natural background, loads from septic tanks, as well as baseflow contributions. Likewise, the load allocations to each land use also consider natural background, septic tanks and baseflow. Each land use load allocation represents yearly allowable loads of nitrogen and phosphorus. MDE also allocates nitrogen and phosphorus to the Centerville Waste Water Treatment Plant (NPDES permit # MD0020834), which is the only significant point source in the watershed. The current load of nitrogen and phosphorus was determined using effluent concentrations and flows reported in Discharge Monitoring Reports (DMR) from 1997.

II. Summary

The Corsica River[1], approximately 6 miles in length, is a tributary of the Chester River. The lower, tidal portion of the stream enters Chester River near Town Point (in the oligohaline salinity zone) while the head of tide is located at the town of Centreville. The surrounding watershed encompasses approximately 25,000 acres and the dominant land uses are agriculture (15,600 acres or 62%) and forest (6,700 acres or 27%). Open water (1,400 acres) and urban (1,400 acres) comprise the remaining land use distribution[2].

In response to the requirements of Section 303(d) of the Clean Water Act (CWA), MDE listed the Corsica River on the 1996 303(d) list of impaired waterbodies based on available information. The specific causes of impairment included signs of eutrophication in the form of elevated chlorophyll-a levels. A eutrophic system typically contains an undesirable abundance of plant growth, particularly phytoplankton (photosynthetic microscopic organisms (algae)), periphyton (attached benthic algae), and macrophytes (large vascular rooted aquatic plants)[3]. These impairments interfere with the designated uses[4] of Corsica River by disrupting the aesthetics of the river and causing harm to inhabited aquatic communities through wide fluctuations of the dissolved oxygen levels. MDE listed nutrients, both nitrogen and phosphorus, from point, nonpoint, and natural sources as the causes and sources of the impairments, respectively. Corsica River was given low priority on the 1996 303(d) list. Section 303(d) of the CWA and its implementing regulations require a TMDL to be developed for those waterbodies identified as impaired by the State where technology-based and other controls did not provide for attainment of water quality standards. The TMDLs submitted by Maryland are designed to address acceptable levels of nitrogen and phosphorus, as demonstrated by the WASP5 model, in order to ensure that water quality standards are maintained. These levels of nitrogen and phosphorus will provide for the control of eutrophication and algae blooms (measured through a surrogate indicator known as chlorophyll-a) and ensure that the water quality criterion for dissolved oxygen is attained.

MDE developed these TMDLs to address the excessive nutrient enrichment that Corsica River is currently experiencing. This TMDL is designed to satisfy the water quality standards and designated uses of Corsica River only for nutrients. Impairments in the remainder of the Chester River watershed are not addressed by this TMDL. In addition, impairments due to suspended sediments or fecal coliform are not addressed by these TMDLs.

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[1] The Corsica River watershed, part of the Upper Eastern Shore Tributary Strategy Basin, is located in Queen Anne's County. It is listed as sub-basin 02-13-05-07.

[2] This information is based on 1994 Maryland Office of Planning information.

[3] Protocol for Developing Nutrient TMDLs. First Edition. November 1999. EPA 841-B-99-007.

[4] The designated uses of Corsica River are Use I (Water Contact Recreation and Protection of Aquatic Life) for all free-flowing tributaries and Use II (Shellfish Harvesting) for the estuarine portion (below Earl Cove). See Code of Maryland Regulations 26.08.02.

In order to address the impairments of Corsica River from the 303(d) list, MDE believes it is necessary to control excessive nutrient input to the system. Nitrogen and phosphorus are factors which exert influence on not only the concentrations of dissolved oxygen in a waterbody but also biomass (typically characterized as algae or phytoplankton and measured as chlorophyll-a for modeling purposes). The figure below illustrates the interrelationship of major kinetic processes for BOD, DO, and nutrient analysis.

Nutrient enrichment and subsequent algal growth are a concern in rivers and streams because of their effect on dissolved oxygen concentrations. Growing plants provide a net addition of dissolved oxygen to the stream on an average daily basis, yet respiration can cause low dissolved oxygen levels at night that can affect the survival of less tolerant fish species. Also, if environmental conditions cause a die-off of either microscopic or macroscopic plants, the decay of biomass can cause severe oxygen depressions. Therefore, excessive plant growth can affect a streams ability to meet both average daily and instantaneous dissolved oxygen standards[5]. In addition, excessive nutrients lead to an overabundance of aquatic plant growth.

MDE uses WASP5[6] to evaluate the link between nutrient loadings, algal growth, and dissolved oxygen. This evaluation is based on representing current conditions within the Corsica River system and determining the necessary reductions in nutrient loadings from various sources to achieve and maintain water quality standards. WASP5 is a general-purpose modeling system for assessing the fate and transport of conventional and toxic pollutants in surface waterbodies (Ambrose, 1987)[7]. The model can be applied in one, two, or three dimensions and includes 2 sub-models (EUTRO5 and TOXI5) to investigate water quality/eutrophication and toxics impairments. EUTRO5 can simulate the transport and transformation of eight state variables including dissolved oxygen, carbonaceous biochemical oxygen demand, phytoplankton carbon and chlorophyll-a, ammonia, nitrate, organic nitrogen, organic phosphorus, and orthophosphate. WASP5 has been previously applied in a number of regulatory and water quality management applications and is an appropriate linkage evaluation tool for the Corsica River. Based on this analysis, MDE has determined that the levels of nutrient input to the Corsica River specified by the TMDL will ensure that water quality standards are achieved by controlling algae blooms and maintained the dissolved oxygen water quality criterion.

[5] Technical guidance Manual for Developing Total Maximum Daily Loads, Book 2: Streams and Rivers, Part 1: Biochemical Oxygen Demand/Dissolved Oxygen and Nutrients/Eutrophication. Section 4.2.1.2. March 1997. EPA 823-B-097-002.

[6] Ambrose, R.B., T.A. Wool, and J.L. Martin. 1993. The water quality simulation program, WASP5 version 5.10. Part A: Model documentation. U.S. EPA, ORD, ERL, Athens, GA.

[7] Compendium of Tools for Watershed Assessment and TMDL Development. May 1997. EPA 841-B-97-006.

Table 1 below shows a summary of the TMDL as determined by MDE.

Table 1, Summary of Phosphorus and Nitrogen TMDLs*

Flow Regime (Period)	Parameter	TMDL	WLA	LA	MOS	FA
Low-flow (May 1 - Oct. 31)	Nitrogen (lbs/month)	1,379	625	427	209	118
	Phosphorus (lbs/month)	202	117	13	48	24
Average-flow (Nov. 1 - April 30)	Nitrogen (lbs/year)	287,670	7,598	268,211	10,327	1,534
	Phosphorus (lbs/year)	22,244	1,424	19,380	1,152	288

*The following is a clarification of table 1. The WLAs for low-flow are applicable from May 1 to October 31 in order to provide compliance with water quality standards during this critical period. The TMDL and WLA for low-flow is based on relocating the current discharge from Centreville to a point downstream of the Watson Road Bridge as well as implementation of Biological Nitrogen Removal (BNR). Alternatively, MDE states that the discharge from Centreville WWTP may remain at its current location if both BNR and Chemical Phosphorus Removal (CPR) are implemented during the months of December through March as a seasonal surface discharge and spray irrigation is implemented during the remaining eight months. The average-flow WLA values are also based on the achieving the same design flow and reduced loads year-round. The LAs for low-flow represent flows developed using a United States Geological Survey regression analysis and 1997 field survey data taken in the Corsica River watershed.

III. Discussion of Regulatory Conditions

EPA finds that Maryland has provided sufficient information to meet all of the 8 basic requirements for establishing nitrogen and phosphorus TMDLs for the Corsica River. EPA therefore approves the TMDLs, Technical Memoranda, and supporting documentation for nitrogen and phosphorus in the Corsica River. Our approval is outlined according to the regulatory requirements listed below.

1) The TMDL is designed to implement the applicable water quality standards.

MDE has indicated that algae blooms and localized low dissolved oxygen concentrations due to excessive nutrient input have caused violations of the water quality standards and designated uses applicable to the Corsica River. As previously mentioned, the designated uses of Corsica River are Use I and II. The dissolved oxygen water quality criterion to support those uses indicates that DO concentrations may not be less than 5 mg/l at any time. While Maryland does not have numeric water quality criteria for nitrogen and phosphorus, Maryland interprets it's General Water Quality Criteria to provide numerical objectives for nitrogen and phosphorus

which will support the dissolved oxygen water quality criterion as well as a surrogate indicator (chlorophyll-a)[8] to determine acceptable algae levels in the Corsica River. Chlorophyll-a is desirable as an indicator because algae are either the direct (e.g. nuisance algal blooms) or indirect (e.g. high/low DO and pH and high turbidity) cause of most problems related to excessive nutrient enrichment[9]. The WASP5 model used by Maryland will help to determine those nutrient levels and compliance with the DO criterion and chlorophyll-a levels.

The presence of aquatic plants in a waterbody can have a profound effect on the DO resources and the variability of the DO throughout a day or from day to day[10]. This is due to the photosynthetic and respiration processes of aquatic plants which can cause large diurnal variations in DO that are harmful to fish. Photosynthesis is the process by which plants utilize solar energy to convert simple inorganic nutrients into more complex organic molecules[11]. Due to the need for solar energy, photosynthesis only occurs during daylight hours and is represented by the following simplified equation (proceeds from left to right):

$$\underset{\text{(Carbon Dioxide)}}{6CO_2} + \underset{\text{(Water)}}{6H_20} \text{ <-----------> } \underset{\text{(Sugar)}}{C_6H_{12}O_6} + \underset{\text{(Oxygen)}}{6O_2}$$

In this reaction, photosynthesis is the conversion of carbon dioxide and water into sugar and oxygen such that there is a net gain of DO in the waterbody. Conversely, respiration and decomposition operate the process in reverse and convert sugar and oxygen into carbon dioxide and water resulting in a net loss of DO in the waterbody. Respiration and decomposition occur at all times and are not dependent on solar energy. Waterbodies exhibiting typical diurnal variations of DO experience the daily maximum in mid-afternoon during which photosynthesis is the dominant mechanism and the daily minimum in the predawn hours during which respiration and decomposition have the greatest effect on DO and photosynthesis is not occurring. In order to ensure that the DO concentration of 5mg/l is met at all times, MDE calculates both the daily average dissolved oxygen concentrations and the minimum diurnal DO concentrations as a result of photosynthesis and respiration of phytoplankton using the WASP5 model.

In addition to the negative effects on DO, an overabundance of aquatic plant growth adversely impacts the aesthetic and recreational uses of a waterbody by decreasing water clarity and forming unsightly floating algae blooms which also hinder navigation. MDE utilizes

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[8] Chlorophyll-a is typically used as a measure of algal biomass in natural waters because most algae have chlorophyll as the primary pigment for carbon fixation (EPA 823-B-97-002).

[9] Supra, footnote 3

[10] Principles of Surface Water Quality Modeling and Control. Robert V. Thomann., and J.A. Mueller. 1987. Page 283.

[11] Surface Water-Quality Modeling. Steven C. Chapra. 1997. Page 347.

chlorophyll-a, a surrogate indicator for algal biomass[12], to evaluate the link between nutrient loadings and aquatic plant levels necessary to support the designated uses of Corsica River. Again, using their General Water Quality Criteria, MDE establishes a numeric chlorophyll-a goal of 50 ug/l. This level is based on the goals/strategies recommended by the Algal Bloom Expert Panel to prevent the occurrence of algal blooms similar to those experienced in the Potomac Estuary in 1983[13]. Specifically, the panel believed that nuisance conditions from algal blooms occurred when chlorophyll-a concentrations exceeded 100 ug/l. Similar to the nutrient-DO evaluation, MDE uses the WASP5 model to determine acceptable levels of loadings of nutrients to achieve a chlorophyll-a concentration of 50 ug/l.

EPA believes that the TMDLs for phosphorus and nitrogen will ensure that the designated uses and water quality criteria for the Corsica River are met and maintained.

2) The TMDLs include a total allowable load as well as individual waste load allocations and load allocations.

Total Allowable Loads

The critical season for excessive algal growth in the Corsica River has been identified by Maryland as the summer months. During these months, flow in the channel is reduced resulting in slower moving, warmer water which has less dilution potential and is susceptible to algal blooms and low dissolved oxygen concentrations. In order to control the algal activity and its impacts on water quality, particularly with respect to DO levels, Maryland has established individual TMDLs for nitrogen and phosphorus that are applicable from May 1 through October 31. Maryland presented these as monthly loads to be consistent with the monthly concentration limits that are required by NPDES permits. Expressing the TMDLs as monthly loads is consistent with federal regulations at 40 CFR 130.2(I), which state that TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure.

Maryland also recognized that nutrients may reach the river in significant amounts during higher flow periods. While available data and predictive modeling does not indicate any problems with chlorophyll-a levels or low DO concentrations during these times, Maryland performed the average annual flow analysis in order to characterize the impact of nonpoint source nutrient loadings. Although the water quality problems occur during low flow, the annual TMDLs are intended to prevent backsliding on current nonpoint source loads, thereby making an initial effort to address possible sedimentation problems when the situation is further evaluated.

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[12] Biomass is defined as the amount, or wieght, of a species, or group of biological organisms, within a specific volume or area of an ecosystem (EPA 823-B-97-002).

[13] Thomann, R.V., N.J. Jaworski, S.W. Nixon, H.W. Paerl, and J. Taft. March 14, 1985. Algal Bloom Expert Panel. The 1983 Algal Bloom in the Potomac Estuary. Prepared for the Potomac Strategy State/EPA Management Committee.

The TMDLs for nitrogen and phosphorus are presented in Table 1 above.

EPA's regulations at 40 CFR 130.2(I), define "total maximum daily load (TMDL)" as the "sum of individual WLAs for point sources and LAs for nonpoint sources and natural background." As the total loads provided by Maryland equal the sum of the individual WLAs for point sources and the land-based LAs for nonpoint sources set forth below and in the Technical Memoranda provided with the TMDLs, the TMDLs for nitrogen and phosphorus for Corsica River are consistent with Section 130.2(I). Pursuant to 40 CFR 130.6 and 130.7(d)(2), these TMDLs and the Technical Memoranda and supporting documentation, should be incorporated into Maryland's current water quality management plan.

Waste load Allocations

EPA regulations require that an approveable TMDL include individual WLAs for each point source. Maryland's TMDL report for the Corsica River did not include an individual waste load allocation for the single point source (Centreville Wastewater Treatment Plant, NPDES permit # MD0020834) of nitrogen and phosphorus. However, the Technical Memorandum did provide a waste load allocation scenario for both the low-flow and average-flow TMDLs. The WLA for Centreville WWTP is listed below.

Table 2, Summary of low-flow and average-flow WLAs for nitrogen and phosphorus

Centreville Wastewater Treatment Plant				
NPDES Permit Number MD0020834				
Parameter	Flow Regime	Current Loading	TMDL loading	% reduction needed
Nitrogen[a]	low-flow (lbs/month)	n/a	625	n/a
Phosphorus[b]		n/a	117	n/a
Nitrogen[a]	average annual (lbs/year)	12,899	7,598	41%
Phosphorus[b]		2,511	1,424	43%

[a] The low-flow and average annual WLA for nitrogen is based on a discharge flow of 0.375 million gallons per day and a concentration of 8 mg/l.

[b] The low-flow and average annual WLA for phosphorus is based on a discharge flow of 0.375 million gallons per day and a concentration of 1.5 mg/l.

n/a - The current monthly permit limits for the months of May 1-Oct 31 were not provided.

The point source loads used to represent the expected current conditions were calculated using effluent data gathered from DMRs from 1997. The WLAs of the TMDL represent point source loads which will provide compliance with the water quality standards mentioned in Section 1 above. While the low-flow, monthly WLA values are most applicable from May 1 to October 31, the average annual WLA values are based on achieving these monthly WLA values year-round. The low-flow TMDL analysis was accomplished using nonpoint source loads which are based on 1997 field survey data from the Corsica River.

Load Allocations

Maryland provided adequate land use and loading data in the TMDL report, but did not distribute the total load allocation to specific land use categories in the TMDL report. Maryland included a gross load allocation for the low-flow and average-flow TMDLs. Those gross load allocations are contained in Table 1.

According to federal regulations at 40 CFR 130.2(g), load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Wherever possible natural and nonpoint source loads should be distinguished. MDE uses the Chesapeake Bay Program model Phase IV loading coefficients (Year 2000 scenario) which are land use specific and include natural background contributions, atmospheric deposition (to land and/or water), and baseflow contributions.

As noted above, Maryland did not provide a breakdown of the load allocation in the TMDL report, however, such a breakdown was provided in the Technical Memorandum. The TMDL is based on nitrogen and phosphorus loading from the 4 land uses/sources within the watershed. According to the Technical Memorandum, the specific load allocations for the TMDL are as follows:

Table 3, Summary of Load Allocations for nitrogen

Land Use Category	% Land Use	Watershed Area (acres)	% Nonpoint source current load	Nonpoint source current load (lbs/yr)	% nonpoint source TMDL load	Nonpoint source TMDL load (lbs/yr)	% reduction needed
Agriculture	62.23	15,603	83.5	224,015	83.5	224,015	-
Forest	26.81	6,722	5.9	15,873	5.9	15,873	-
Urban	5.45	1,367	3.6	9,787	3.6	9,787	-
Atmospheric Deposition directly to water	5.51	1,381	7	18,535	7	18,535	-
Total	100	25,073	100	268,211	100	268,211	0

Table 4, Summary of Load Allocations for phosphorus

Land Use Category	% Land Use	Watershed Area (acres)	% Nonpoint source current load	Nonpoint source current load (lbs/yr)	% nonpoint source TMDL load	Nonpoint source TMDL load (lbs/yr)	% reduction needed
Agriculture	62.23	15,603	89.5	17,346	89.5	17,346	-
Forest	26.81	6,722	1.6	317	1.6	317	-
Urban	5.45	1,367	3.5	687	3.5	687	-
Atmospheric Deposition directly to water	5.51	1,381	5.4	1,030	5.4	1,030	-
Total	100	25,073	100	41,987	100	41,987	0

Allocations Scenarios

EPA realizes that the above breakout of the total loads for nitrogen and phosphorus to the point sources and nonpoint sources is one allocation scenario. As implementation of the established TMDLs proceed, Maryland may find that other combinations of point and nonpoint source allocations are more feasible and/or cost effective. However, any subsequent changes in the TMDL must conform to gross waste load and load allocations and must ensure that the biological, chemical, and physical integrity of the waterbody is preserved.

Federal regulations at 40 CFR 122.44(d)(1)(vii)(B), require that, for an NPDES permit for an individual point source, the effluent limitations must be consistent with the assumptions and requirements of any available WLA for the discharge prepared by the State and approved by EPA. EPA has authority to object to the issuance of an NPDES permit that is inconsistent with WLAs established for that point source. To ensure consistency with these TMDLs, as NPDES permits are issued for the point sources that discharge the pollutants of concern to Corsica River, any deviation from the WLAs set forth in the Technical Memoranda and described herein for the particular point source must be documented in the permit Fact Sheet and made available for public review along with the proposed draft permit and the Notice of Tentative Decision. The documentation should; 1) demonstrate that the loading change is consistent with the goals of the TMDL and will implement the applicable water quality standards, 2) demonstrate that the changes embrace the assumptions and methodology of these TMDLs and Technical Memoranda, and, 3) describe that portion of the total allowable loading determined in the State's approved TMDL report that remains for other point sources (and future growth where included in the original TMDL) not yet issued a permit under the TMDL. It is also expected that Maryland will provide this Fact Sheet, for review and comment, to each point source included in the TMDL analysis as well as any local and State agency with jurisdiction over land uses for which load allocation changes may be impacted.

In addition, EPA regulations and program guidance provides for effluent trading. Federal

regulations at 40 CFR 130.2 (I) state: "If Best Management Practices (BMPs) or other nonpoint source pollution controls make more stringent load allocations practicable, then wasteload allocations may be made less stringent. Thus, the TMDL process provides for nonpoint source control tradeoffs." The State may trade between point sources and nonpoint sources identified in this TMDL as long as three general conditions are met; 1) the total allowable load to the waterbody is not exceeded, 2) the trading of loads from one source to another continues to properly implement the applicable water quality standards and embraces the assumptions and methodology of these TMDLs and Technical Memoranda, and 3) the trading results in enforceable controls for each source. Final control plans and loads should be identified in publicly available planning document, such as the State's water quality management plan (see 40 CFR 130.6 and 130.7(d)(2). These final plans must be consistent with the goals of the approved TMDLs.

Based on the foregoing, EPA has determined that the TMDLs and the Technical Memoranda for Nitrogen and Phosphorus for Corsica River are consistent with the regulations and requirements of 40 CFR Section 130. Pursuant to 40 CFR 130.6 and 130.7(d)(2), these TMDLs and the supporting documentation, including the Technical Memoranda, should be incorporated into Maryland's current water quality management plan.

3) The TMDL considers the impacts of background pollutant contributions.

In terms of the low-flow TMDL analysis, Maryland used 1997 field data which would adequately consider pollutant contributions from baseflow, which is considered to be most influential during low-flow periods, as well as other nonpoint source contributions such as atmospheric deposition and loads from septic tanks.

In terms of the high-flow TMDL analysis, Chesapeake Bay Model Phase IV loading coefficients (Year 2000 scenario) were used which effectively consider natural background, loads from septic tanks, as well as baseflow contributions.

4) The TMDLs consider critical environmental conditions.

EPA regulations at 40 CFR 130.7(c)(1) require TMDLs to take into account critical conditions for streamflow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of Corsica River is protected during times when it is most vulnerable.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards.[14] Critical conditions are the combination of

[14] EPA Memorandum regarding EPA Actions to Support High Quality TMDLs from Robert H. Wayland III, Director, Office of Wetlands, Oceans, and Watersheds to the Regional Water Management Division Directors, August 9, 1999.

environmental factors (e.g., flow, temperature, etc.) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence. In specifying critical conditions in the waterbody, an attempt is made to use a reasonable "worst-case" scenario condition. For example, stream analysis often uses a low-flow (7Q10) design condition as critical because the ability of the waterbody to assimilate pollutants without exhibiting adverse impacts is at a minimum.

Based on the 1997 field data and current knowledge regarding eutrophication, Maryland identified the summer months as the critical period. The specific conditions that describe this critical period are reduced flows in the stream (low-flow), higher concentrations of nutrients, and warmer water temperatures. These conditions combine to create favorable conditions for algal growth and wide fluctuations in DO concentrations which lead to violations of the designated uses and water quality criteria of Corsica River. Furthermore, the data showed that chlorophyll-a levels were of concern and DO concentrations were violating the water quality criteria in the upper reaches of Corsica River due to the localized impacts of Centreville WWTP. The low-flow TMDL analysis using the WASP5 model adequately considers those critical conditions.

The State also recognizes that increased nonpoint source loads of nutrients during precipitation events could adversely affect water quality, thus a critical condition itself, despite the fact that the stream is sufficiently flushed to avoid water quality impairments in the vicinity of Centreville WWTP. In particular, MDE has identified that nutrient laden sediments deposited at the head of the Corsica River may be causing excessive sediment oxygen demand (SOD). The State currently lacks the necessary information to accurately quantify this potential concern. However, MDE has taken an environmentally-conscious approach and developed an annual TMDL based on average flow conditions which quantify the current nonpoint source loading of nutrients and seek to prevent backsliding on those current loading levels.

5) The TMDLs consider seasonal environmental variations.

Seasonal variations involve changes in streamflow as a result of hydrologic and climatological patterns. In the continental United States, seasonally high flow normally occurs during the colder period of winter and in early spring from snowmelt and spring rain, while seasonally low flow typically occurs during the warmer summer and early fall drought periods[15]. Consistent with our discussion regarding critical conditions, the WASP5 model and TMDL analysis will effectively consider seasonal environmental variations.

6) The TMDLs include a margin of safety.

This requirement is intended to add a level of safety to the modeling process to account for any uncertainty. Margins of safety may be implicit, built into the modeling process, or explicit, taken as a percentage of the wasteload allocation, load allocation, or TMDL.

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[15] Technical Guidance Manual for Developing Total Maximum Daily Loads, Book 2, Part 1, Section 2.3.3, (EPA 823-B-97-002, 1997).

In terms of the low-flow TMDL analysis for both nitrogen and phosphorus, MDE states that it explicitly allocates 5% of the LA value and reserves this for the MOS. For the high-flow TMDL analysis, MDE explicitly allocates 3% of the LA value and reserves this for the MOS. However, analysis indicates that the margins of safety represent much larger percentages of the load allocations.

In addition, MDE uses certain conservative assumptions which are implicitly included in the modeling process. The low-flow analysis sets a goal of 50 ug/l for chlorophyll-a which MDE believes is conservative given the generally acceptable range of chlorophyll-a values for waters meeting their water quality standards of 50 - 100 ug/l. The high-flow analysis was run under the assumption that summer water temperatures and summer solar radiation would be experienced by the Corsica River. These conditions are unlikely given that high-flow analyses are typically done during winter and spring months of the year.

7) The TMDLs have been subject to public participation.

The TMDLs of nitrogen and phosphorus to the Corsica River were open for public comment from November 4, 1999 through December 6, 1999. Only one set of written comments were received by MDE, which was provided along with their response document with the TMDL report.

8) There is a reasonable assurance that the TMDL can be met.

EPA requires that there be a reasonable assurance that the TMDL can be implemented. WLAs will be implemented through the NPDES permit process. According to 40 CFR 122.44(d)(1)(vii)(B), the effluent limitations for an NPDES permit must be consistent with the assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA. Furthermore, EPA has authority to object to issuance of an NPDES permit that is inconsistent with WLAs established for that point source.

Nonpoint source controls to achieve LAs can be implemented through a number of existing programs, including Maryland's Lower Potomac Tributary Strategy, which was developed as part of Maryland's commitment under the Chesapeake bay Agreement. Other existing program include EPA's Clean Water Action Plan and Maryland's Water Quality Improvement Act of 1998.

In addition, there will be follow-up monitoring within five years as part of Maryland's Watershed Cycling Strategy. This follow-up monitoring will allow Maryland and EPA to determine whether these TMDLs have been implemented successfully.